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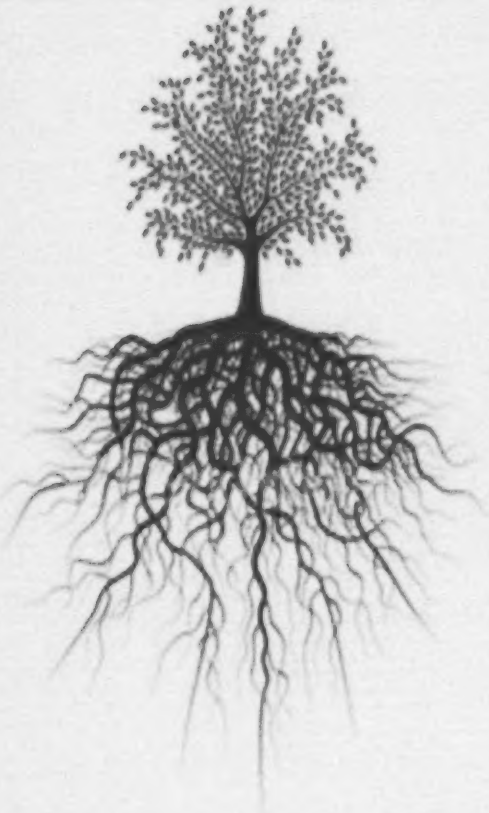
CCDR SUPPLEMENT

CANADA COMMUNICABLE DISEASE REPORT

SOCIAL DETERMINANTS OF HEALTH



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CCDR
CANADA COMMUNICABLE DISEASE REPORT

The Canada Communicable Disease Report (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authoritative and practical information on infectious diseases to clinicians, public-health professionals, and policy-makers to inform policy, program development and practice.

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CANADA COMMUNICABLE DISEASE REPORT

SUPPLEMENT

SOCIAL DETERMINANTS OF HEALTH

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EDITORIAL

Advancing health equity to improve health: The time is now†

Jackson B[1], Huston P[2]

Abstract

Health inequities, or avoidable *inequalities* in *health* between groups of people, are increasingly recognized and tackled to improve public health. Canada's interest in health inequities goes back over 40 years, with the landmark 1974 Lalonde report, and continues with the 2011 Rio Political Declaration on Social Determinants of Health, which affirmed a global political commitment to implementing a social determinants of health approach to reducing health inequities. Research in this area includes documenting and tracking health inequalities, exploring their multidimensional causes, and developing and evaluating ways to address them. Inequalities can be observed in who is vulnerable to infectious and chronic diseases, the impact of health promotion and disease prevention efforts, how disease progresses, and the outcomes of treatment. Many programs, policies and projects with potential impacts on health equity and determinants of health have been implemented across Canada. Recent theoretical and methodological advances in the areas of implementation science and population health intervention research have strengthened our capacity to develop effective interventions.

With the launch of a new health equity series this month, the journals *Canada Communicable Disease Report* (CCDR) and *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice* (HPCDP Journal) will continue to reflect and foster analysis of social determinants of health and focus on intervention studies that advance health equity.

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†Note: The text of this paper is identical in content to the primary article published in the *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice* journal and released electronically on February 18, 2016 having met the guidelines for simultaneous publication as set forth by the International Committee of Medical Journal Editors (www.icmje.org). The *CCDR* version has an additional Appendix.

Introduction

The World Health Organization (WHO) defines health in inequity as "avoidable inequalities in health between groups of people within and between countries" (1). Not only is health equity an international and domestic concern, it is a fertile field of research and practice across disciplines, sectors and jurisdictions.

While a majority of Canadians enjoy good health, health inequalities persist and, in some areas, are growing (2,3). But much can be done to address this. The objective of this introductory commentary is to review some key milestones in domestic and global health equity work, highlight recent advances and recommended actions in Canada, and assert that new evidence on inequalities and interventions can create promising opportunities for collaborative action across sectors to address health equity and improve health.

Key Milestones

Early days

The landmark 1974 Lalonde report, *"A New Perspective on the Health of Canadians,"* asserted that the quantity, quality and arrangement of acute health care systems explain only a fraction of why a population is healthy (4). The "health fields" identified in the report (biology, individual choices, physical and social environments, and health care) were an early expression of what would become known as the "social determinants of health." The Lalonde report was quickly followed by other key policy documents: the WHO Alma-Ata Declaration on Primary Health Care in 1978 (5); the Canadian Epp Report, *Achieving Health for All* (6), and the WHO "Ottawa Charter for Health Promotion" in 1986 (7). Later key publications such as *Why Are Some People Healthy and Others Not? The Determinants of Health of Populations* (8) and *Strategies for Population Health: Investing in the Health of Canadians* in 1994 (9) signalled a reframing of public health into a "population health" perspective, informed by social determinants of health.

Calls for global action

WHO Commission on Social Determinants of Health

In 2008, the WHO Commission on Social Determinants of Health made a clear link between the social determinants of health and health equity in its report *Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health* (10). The Commission stated: "inequities in health, avoidable health inequalities, arise because of the circumstances in which people grow, live, work, and age, and the systems put in place to deal with illness. The conditions in which people live and die are, in turn, shaped by political, social, and economic forces" (10). The Commission's three overarching recommendations and related principles of action focused on:

- improving daily living conditions;
- tackling the inequitable distribution of power, money and resources—the structural drivers of the conditions of daily life; and
- measuring the extent of health inequities and assessing the health equity impact of policy and other actions (10).

This renewed call for global action has supported efforts in Canada in the public health sector and across sectors. Reflecting growing urgency and better understanding of approaches to health that focus on social determinants and equity, another appeal for action was issued at the 2011 World Conference on Social Determinants of Health in Rio de Janeiro.

Rio Political Declaration on Social Determinants of Health

In May 2012, Canada and other United Nations Member States endorsed the Rio Political Declaration on Social Determinants of Health (11). The declaration expresses global political commitment for the implementation of a social determinants of health approach to reduce health inequities. Aiming to build international momentum for the development of dedicated national action plans and strategies, the Declaration identified five action areas critical to addressing health inequities:

- adopt better governance for health and development;
- promote participation in policy making and implementation;
- reorient the health sector towards reducing health inequities;
- strengthen global governance and collaboration; and
- monitor progress and increase accountability (11).

Canadian collaboration and action

The Chief Public Health Officer's Report

Addressing both health equity and the determinants of health, the Chief Public Health Officer's (CPHO) inaugural report (2) identified several priority areas and ways to address health inequalities in Canada:

- social investments (particularly for families with children living in poverty and for early childhood development);
- community capacity to address social determinants of health and health equity;
- integrated policies and joint action across sectors and jurisdictions;
- knowledge infrastructure to assess the health of subpopulations and the efficacy, adaptability and scalability of interventions; and
- leadership within and beyond the health sector (2).

These priority areas remain relevant today as jurisdictions and sectors in Canada work together to address health inequities.

The Pan-Canadian Public Health Network

The Pan-Canadian Public Health Network (PHN) is a network of individuals from many sectors and levels of government, who effectively work together to strengthen public health in Canada. The PHN includes academics, researchers, public servants, members of non-governmental organizations and health professionals and is governed by a council of federal/provincial/territorial government representatives including the CPHO and senior public health officials from all jurisdictions. In 2010, the PHN council endorsed a set of *Indicators of Health Inequalities* (12) and recommended that the Public Health Agency of Canada (PHAC), the Canadian Institute for Health Information (CIHI) and Statistics Canada report on these indicators. This pan-Canadian initiative will provide baseline data on over 50 indicators of health outcomes (for both chronic and infectious diseases), health-related behaviours and social determinants of health inequalities (e.g. food security). These data will be stratified, where possible, by a wide range of variables related to identity and social location (including sex, socioeconomic status, Aboriginal identity, cultural and/or racial background, immigrant status, rural/urban residence and sexual orientation). Results from this initiative, expected in 2016, will provide new information to federal, provincial and territorial governments and civil society to support decision making, priority setting, development of effective interventions, and monitoring of health inequalities.

The Canadian Council on Social Determinants of Health

The Canadian Council on Social Determinants of Health (CCSDH) is a collaborative, multisectoral stakeholder group established by PHAC in 2005 (as the Canadian Reference Group) to support Canada's contribution to the WHO Commission on the Social Determinants of Health. Since then, its role has evolved in recognition of the importance of broad intersectoral engagement for effectively addressing health inequities. The current dual mandate of the CCSDH is to advise PHAC on implementing the Rio Political Declaration on Social Determinants of Health (11) and to facilitate and leverage action on the social determinants of health and health inequalities in Canada. CCSDH membership includes representatives from all levels of government, civil society, business, labour and academia and from among Aboriginal peoples; members have been selected for their expertise and experience in addressing

the social determinants of health. The Council is co-chaired by a PHAC representative appointed by the CPHO.

From knowledge to action

While substantial progress has been made in tracking health inequalities, such knowledge alone does not improve health. Advances in health equity require complementary interventions at multiple levels (behavioural, organizational and societal/systemic) across different populations in different contexts (13).

Recent advances

In the last five years, a range of programs, policies and projects on health equity and determinants of health have been implemented across Canada in various jurisdictions. Some of these actions are described in the Rio Political Declaration on Social Determinants of Health: A snapshot of Canadian actions 2015 (14). See **Appendix** for some highlights of recent initiatives across Canada.

In November 2015, the Canadian Institute for Health Information released a suite of products from its "Trends in Income-Related Health Inequalities in Canada" (3) project. These products—including a technical report and an interactive online tool—examine changes in income-related health inequalities over the past decade. For 11 of 16 indicators (including both social determinants and health outcomes), the health gap between higher-income and lower-income groups did not change. However, for 3 indicators (smoking, hospitalization of adults for chronic obstructive pulmonary disease, and fair/poor self-rated mental health) the gap widened. While inequalities decreased for the remaining 2 indicators, this was the result of a "levelling down" effect, where health outcomes worsened among higher-income groups and remained the same in lower-income groups. This documentation of income-related trends in health inequalities makes an important contribution to Canadian evidence.

Future directions

Two important advances in applied research are particularly interesting in terms of our equity series: implementation science and population health intervention research.

Implementation science

Implementation science is the study of methods that promote the integration of research findings and evidence into health care policy and practice (15). It addresses the challenges of implementation, applying advances from one area to another, and the scaling-up of interventions. Implementation science is informed by a range of research and practice disciplines, building on operations research, participatory action research, management science, quality improvement and impact evaluation.

Implementation science has been used to enhance equity in health in Canada and elsewhere. Participants in recent consultative meetings organized by the Alliance for Health Policy and Systems Research of the WHO, the United States Agency for International Development and the World Bank Group noted that implementation science should promote a culture of evidence-informed learning, engage stakeholders and improve decisions on policies and programs to achieve better health outcomes (16).

An excellent example of implementation science improving a health outcome was one that addressed housing and HIV. Evidence shows that the lack of adequate housing is a barrier to HIV treatment and follow-up and is associated with an increased risk of forward transmission (17). Housing assistance for people with HIV who were formerly homeless or inadequately housed was found to improve their outcomes (17). In fact, adequate housing is linked to improved health for a number of health conditions (18).

Population health intervention research

Population health intervention research (PHIR) is similar to implementation science in that it focuses on policies and programs (frequently outside the health sector) that have the potential to improve health equity and health at the population level (19). However, the objective of PHIR is broader: it generates knowledge about whether specific interventions work, how they work, for whom and under what circumstances. It is also concerned with how classes and programs of interventions affect health and health equity in populations. PHIR concentrates on population health interventions, recognizing unique features of these interventions and the unique combination of tools required to study them. With this knowledge, we are better equipped to design interventions that can be effective for different populations across geographies and circumstances, and better equipped to advance health equity.

The challenges of this type of research are substantial, however, given "the involvement of actors from diverse sectors, the multiplicity of interacting components, the unique characteristics of public health as a key delivery system, the need to take into account the influence of context on both intervention implementation and its effective mechanisms, and the specific ethical issues raised with population health interventions" (20).

An excellent example of an upstream intervention that had significant effects on population health was the MINCOME social experiment, which aimed to alleviate poverty by providing residents of Dauphin, Manitoba with a guaranteed annual income (GAI). While the main objective of the original study (conducted from 1974–79) was to assess the impact of a GAI on the labour market, recent intervention research has focussed on the population health effects of the GAI. Results have shown that hospitalizations for accidents, injuries and mental health issues, as well as physician contact for mental health complaints, declined over the course of the experiment relative to a matched comparison group. Moreover, more adolescents involved in the experiment stayed on to complete high school, resulting in a variety of other health and social benefits that would have a significant impact over their life course (21).

Conclusion

The goal of working on health equity and determinants of health is to improve the health of the population and to ensure that the conditions that support health are distributed fairly. Canada has been making important strides in measuring and monitoring health inequalities, strengthening data infrastructure, building

open information systems, undertaking sophisticated analyses of health inequalities, as well as conducting and evaluating the effectiveness of interventions. These efforts are strengthening the capacity of public health and other sectors to tackle health inequities.

With the launch of a new health equity series this month, both the *Canada Communicable Disease Report* (CCDR) and the *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice (HPCDP)* (http://phac-aspc.qc.ca/publicat/hpcdp-pspmc/36-2/index-eng.php) journal welcome reports on applied research that assess strategies to mitigate inequity and improve health outcome while continuing to publish reports that track, monitor and analyze health inequities. The aim is to increase knowledge and capacity to act on social determinants, and rigorously evaluate our efforts to advance equity and improve health.

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Conflict of interest

None.

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Appendix: Highlights of Canadian Actions in 2015 Across the Five Themes of the Rio Political Declaration on Social Determinants of Health (14)

Theme One: To adopt better governance for health and development

Support Development of Healthy Public Policies

- Canadian Experiences in Institutionalizing Health Impact Assessment (National Collaborating Centre for Healthy Public Policy, 2013)

Work Across Sectors to Combat Poverty and Improve Social Protection

- Alberta's Social Policy Framework (Government of Alberta, 2013)
- Newfoundland and Labrador Poverty Reduction Strategy (Government of Newfoundland and Labrador, 2014)
- Overcoming Poverty Together: The New Brunswick Economic and Social Inclusion Plan, 2014–2019 (Economic and social Inclusion Corporation)
- Saskatchewan Poverty Reduction Strategy (Government of Saskatchewan, 2014)
- Collaboration for Poverty Reduction Act (Government of Nunavut, 2013)
- Government of Northwest Territories Anti-Poverty Action Plan: Building on the Strengths of Northerners 2014/15–2015/16 (Government of Northwest Territories, 2014)

Collaborate Across Sectors to Address a Key Social Determinant of Health

- Framework for Early Childhood Development: Right from the Start (Government of the Northwest Territories, 2013)
- At Home/Chez Soi Final Report (Mental Health Commission of Canada, 2014)

Theme Two: To promote participation in policy making and implementation

Open, Transparent and Engaging Governments

- Canada's Action Plan on Open Government 2014–16 (Government of Canada, 2014)
- Newfoundland and Labrador Open Government Initiative (Government of Newfoundland and Labrador, 2014)

Engage and Empower Communities to Participate in Decision Making

- Communicating the Social Determinants of Health (Canadian Council on Social Determinants of Health, 2013)
- Select YouTube videos mobilizing action, including:
  - Let's Start a Conversation About Health . . . and Not Talk About Health Care at All (Sudbury District Health Unit, 2013)
- Social Inequalities in Health (Montréal Public Health, 2014)
- A Guide to Community Engagement Frameworks for Action on the Social Determinants of Health and Health Equity (National Collaborating Centre for Determinants of Health, 2013)

Empower Aboriginal Peoples for Self-Governance

- Update on British Columbia Tripartite Framework Agreement on First Nation Health Governance—Establishing the First Nation Health Governance Structure in British Columbia (Government of British Columbia (BC), Government of Canada, BC first Nations)
- Roots of Resilience: Overcoming Inequities in Aboriginal Communities (Canadian Council on Social Determinants of Health, 2013)

Theme Three: To strengthen health systems through health sector leadership for health equity

Strengthen health systems through health sector leadership for health equity

- Toward Health Equity: Canadian Approaches to the Health Sector Role (Public Health Agency of Canada, 2014)
- On the Path Together: Wellness Plan for Yukon's Children and Families (Yukon Health and Social Services, 2014)
- Alberta's Strategic Approach to Wellness (Government of Alberta, 2014)
- New Brunswick's Wellness Strategy 2014–2021: The Heart of Our Future (Government of New Brunswick)

Integrate Equity, Including Gender-Related Considerations, into the Design and Delivery of Programs and Services

- Ontario Public Health Standards (Ontario Ministry of Health and Long-Term Care, 2008; updated 2014)
- Promote, Protect, Prevent: Our Health Begins Here: BC's Guiding Framework for Public Health (British Columbia Ministry of Health, 2013)
- Shaping Science for a Healthier World: Strategy 2017 (Canadian Institutes of Health Research, 2014)
- Physicians and Health Equity: Opportunities in Practice, 2012–2015 (Canadian Medical Association)

Provide Capacity and Tools to Advance Health Equity

- Health Equity Impact Assessment (Ontario Ministry of Health and Long-Term Care)
- Human resources and training for health equity in select Canadian provinces/territories and federal departments

Theme Four: To strengthen global governance and collaboration

Provide Financial Contribution to Countries and International Organizations

- Canada's Ongoing Leadership to improve the Health of Mothers, Newborns and Children (2015–2020) (Government of Canada, 2014)
- Cross-Country Analysis of the Institutionalization of Health Impact Assessment. Social Determinants of Health Discussion Paper Series 8 (World Health Organization, 2013)

Foster North–South Support in Information Sharing and Technical Expertise

- The Handbook on Health Inequality Monitoring: with a Special Focus on Low- and Middle-Income Countries (World Health Organization, 2013)

Theme Five: To monitor progress and increase accountability

Strengthen Monitoring Systems to Report on Health Inequalities

- Pan-Canadian Baseline Reporting on Health Inequalities (Pan-Canadian Public Health Network, Public Health Agency of Canada, Statistics Canada, Canadian Institute for Health Information, 2015)
- Trends in Health Inequalities in Canada (Canadian Institute for Health Information, 2015)
- The Chronic Disease and Injuries Indicator Framework (Public Health Agency of Canada, 2014)
- Social Determinants of Inuit Health in Canada (Inuit Tapiriit Kanatami, 2014)

Provide Methodologies for Monitoring and Reporting on Health Inequalities

- Select reports providing methodologies for monitoring and reporting on health inequalities:
  - A Strategy and Indicators for Monitoring Social Inequalities in Health in Québec (Institut national de santé publique du Québec, 2013)
  - Summary Measures of Socioeconomic Inequalities in Health (Public Health Ontario, 2013)
  - Maps to Inform Intersectoral Planning and Action (Canadian Council on Social Determinants of Health, 2014)

Share Evidence to Inform Policy and Action

- The Canadian Institutes of Health Research: Federal Investments in Health Inequalities and Health Equity Research (Canadian Institutes of Health Research)
- Canadian Best Practices Portal—Equity-Sensitive Interventions (Public Health Agency of Canada, 2015)

DATABASE ANALYSIS

Inequality-related economic burden of communicable diseases in Canada

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Abstract

Background: Communicable diseases cause a significant burden on society in terms of health care expenditures and their health impact on individuals. Cost-of-illness studies estimate the total economic burden of illness and injury.

Objective: To identify the economic burden of illness for communicable diseases in Canada, and to derive the costs associated with inequalities based on income and hospital expenditures.

Methods: Data were derived from the Economic Burden of Illness in Canada (EBIC) database, for the year 2008. Data for communicable diseases were extracted and compared to the overall results. Data on income level was available for hospital expenditures, and was analyzed by income quintile.

Results: The total costs attributable to communicable diseases in Canada were $8.3 billion, which represented 9% of the total costs that could be attributed to a specific disease or diagnostic category. Indirect costs accounted for 44% of total communicable disease costs and represented a more significant proportion of the economic burden related to communicable diseases compared to non-communicable diseases. When hospital costs by income quintile were analyzed, a clear inverse relationship was found between income and hospital expenditures. The costs associated with this inequality in 2008 were $308 million. The current estimates are likely to be an underestimate due to the conservative assumptions made in the analysis.

Conclusion: The cost of communicable disease in Canada is sizable and there is a clear correlation between lower income and higher hospital costs. Further research is needed to better account for co-morbid conditions and to better estimate the value of lost productivity related to disability arising from communicable diseases.

Suggested citation: *Diener A, Dugas J. Inequality-related economic burden of communicable diseases in Canada. Can Comm Dis Rep 2016;42-Suppl 1:S7-13.*

Introduction

Communicable diseases cause a significant burden on society in terms of health care expenditures and their health impact on individuals. According to the most recent Global Burden of Disease project estimates, communicable diseases account for approximately 6% of the total burden of disease in all developed countries and 5% of the burden in Canada, in terms of disability-adjusted life years (DALYs) (1). In Canada, communicable diseases account for about 729 lost health-adjusted life years (HALYs) each year. The United Nations recently highlighted the importance of communicable diseases when the organization noted the need to "...accelerate the pace of progress made in fighting malaria, HIV/AIDS, tuberculosis, hepatitis, Ebola and other communicable diseases and epidemics, including by addressing growing antimicrobial resistance..." in its Sustainable Development Goals (2).

Health burden measured by utility-adjusted life-year measures, such as quality-adjusted life years (QALYs) and DALYs, only tell us part of the story. To understand the full economic burden of such diseases it is necessary to include information on the medical care costs as well as the effects of illness on the economy through decreases in productivity due to disability and premature mortality. Correctly understanding the full economic burden is necessary in order to properly evaluate public and population health programs and policies, including vaccine and immunization strategies, from a societal perspective. This is particularly important given recent concerns related to pandemics and outbreak planning.

Cost-of-illness studies estimate the total economic burden of illness and injury, and can provide valuable information for policy-makers by clarifying the most expensive cost components of treating specific diseases. In addition, estimating the indirect costs associated with illness and injury allows for a better understanding of the effects of preventive measures in terms of societal impacts. This important piece of information can be

used in economic evaluations and the allocation of public health resources.

The overall costs of illness can be defined as the sum of the opportunity costs, or the foregone opportunities in terms of resources, associated with being ill plus the associated psychosocial costs. The opportunity costs can be broken down into direct and indirect costs, while the psychosocial costs are often referred to as intangible costs as they are more difficult to estimate.

The *direct costs* refer to the direct expenditures associated with the treatment of diseases, for example, hospital care, physician care (primary care) and pharmaceutical consumption. In other words, they refer to those services for which some sort of payment is made. The *indirect costs* refer to other economic consequences attributable to illness or injury that result in lost resources but do not involve direct payment related to the disease. This includes labour supply effects such as the value of lost production due to morbidity (i.e. disability) or premature mortality, both of which are included in this analysis. Other indirect costs may include the value associated with caregiving (both formal and informal) or any other costs indirectly related to the health issue of concern.

The *intangible costs* refer to the reduced well-being, emotional distress, pain and other forms of suffering as well as premature mortality attributable to illness and injury that are more difficult to derive. This reduction in health status must be measured and then valued using utility-based methods, or in dollar terms. Utility-based measures combine quantity and quality of life into health-adjusted life measures such as QALYs, HALYs or DALYs. Methods such as the willingness-to-pay approach or the well-being approach can be used to derive monetary valuations of these changes in life status.

While international focus on the costs associated with non-communicable diseases has been increasing recently (e.g. The World Economic Forum report) (3), there is little literature on the overall economic burden of communicable diseases as a whole.

As noted, the Global Burden of Disease project focusses on all types of disease and illness and provides a valid way of comparing across disease groups, including comparisons to and among communicable diseases, using DALYs as its outcome measure. In Ontario, researchers conducted a study of the burden of infectious diseases on population health (4). This study focused on 51 infectious diseases and associated syndromes, and derived the HALYs associated with these. The study found that hepatitis C represented the greatest burden in terms of HALYs. Others included HIV, foodborne diseases (e.g. *Escherichia coli*) and *Clostridium difficile*. However, due to different methodologies it is difficult to compare the results of these studies.

Most cost-of-illness studies have focussed on a particular disease or illness, such as that of HIV/AIDS in Canada (5,6). This lack of a comprehensive study on the overall economic burden of communicable diseases reduces the comparability of results across studies and diseases. Studies have also used different methodologies (e.g., prevalence- vs incidence-based), different cost components, and different measurement and valuation techniques. This ultimately limits the overall use of such results.

The Economic Burden of Illness in Canada (EBIC) database provides objective and comparable information on the cost-of-illness and injury in Canada across 24 diagnostic categories (7). These categories are based on the International Classification of Diseases (ICD) codes and are described in Appendix C of the EBIC 2005–2008 report. In 2008, the total economic burden of illness and injury in Canada was $188.9 billion, with the direct costs accounting for 91% ($172.0 billion) and the indirect costs for 9% ($16.9 billion) of the total costs of illness. However, only 50% of the total economic burden of illness and injury or $94.5 billion of the $188.9 billion, of all costs could be allocated by diagnostic category. As a result, the costs associated with each diagnostic category will be an underestimation of the actual costs. The overall distribution, however, of expenditures is unlikely to be significantly affected. Hence, much of this analysis will focus on the percentage of costs in relation to all allocated expenditures.

In addition, research shows an association between health and socioeconomic status. Those in lower-income groups tend to be less healthy and use more health care resources than those in the higher-income groups (8). McIntosh et al. (9), examining health-adjusted life expectancy in Canada, found that for both sexes there was a near-linear gradient across income deciles for health-adjusted life expectancy at age 25. In other words, compared with people in higher-income deciles, those in lower-income deciles had fewer years of health-adjusted life expectancy. These disparities were substantially larger than those revealed by life expectancy alone. Thus, in order to get the true picture of the economic burden of communicable diseases it is important to also examine the costs associated with such inequalities.

The objective of this paper was to derive the economic burden of illness associated with communicable diseases in Canada and to examine the hospital costs according to socioeconomic status in order to derive the costs associated with inequalities related to the use of the health care system. This analysis used data from the *Economic Burden of Illness in Canada, 2005–2008* (7).

Methods

Data sources

The data used in this analysis were all derived from the *Economic Burden of Illness in Canada, 2005–2008* (EBIC) (7). EBIC uses a prevalence-based approach to estimate the costs associated with illness and injury over a one-year period. A prevalence-based cost-of-illness study estimates the total cost of a disease incurred in a given year regardless of the date of disease onset.

The EBIC database uses a top-down approach to allocate the direct costs (7). The top-down method uses actual expenditure data, such as total hospital expenditures, to allocate the expenditures across all diagnostic categories using a utilization key. One of the benefits of using a top-down approach is that all expenditures are allocated to different disease groups in a mutually exclusive manner, avoiding any possible double

counting. A detailed explanation of data sources has already been published (7). The most recent year of available data is from 2008.

Analysis

In order to examine differences across socioeconomic groups in health care expenditures data, it is necessary to have data on income quintile that can also be allocated by diagnostic category. Income quintile information was only available for the majority of hospital expenditures and was derived using Statistics Canada's Postal Code Conversion File Plus (PCCF+) program. This program uses postal codes to assign socioeconomic and demographic data, including income level, by geographic area. In 2008, the top income quintile represented households (minimum two people) with an income greater than $122,500, while the lowest quintile represented households whose income was below $39,300. The minimum incomes required for quintiles 3 and 4 were $61,400 and $86,100, respectively (10).

Note that income quintile information was not available for all of the hospital expenditure data, specifically data from the Hospital Morbidity Database and the Hospital Mental Health Database, and so these were not included in the cost-by-income quintile analysis. As a result, the hospital expenditures included in the income quintile analysis represent 76% of total EBIC hospital expenditures. In addition, small differences (less than 1% for the communicable disease categories) may be seen between the EBIC and the income quintile analysis results by diagnostic category because more disaggregated data was used to distribute cost totals in the latter analysis.

As noted, the EBIC data are classified according to unique categories based on ICD coding. For the analysis, communicable diseases were defined as the two EBIC diagnostic categories, "Certain Infectious and Parasitic Diseases" and "Respiratory Infections." These correspond to all of ICD Chapter I (Infectious and Parasitic Diseases) and parts of Chapter VI (Diseases of the Nervous System), Chapter X (Diseases of the Respiratory System), and Chapter XIV (Diseases of the Genitourinary System) (see **Appendix**). Costs associated with these diagnostic categories were then compared to the overall economic burden related to all diagnostic categories.

Results

The total costs attributable to communicable diseases were $8.3 billion in 2008, approximately 9% of the total burden of illness (see **Table 1**). This included $4.7 billion in direct costs (56%) and $3.7 (44%) billion in indirect costs. Indirect costs played a much larger role in the economic burden of communicable disease compared to the overall economic burden of illness, where indirect costs were only responsible for 11% of the entire economic burden.

Hospital costs represented the largest component of direct costs related to all communicable diseases, accounting for 39% of the direct costs (**Table 1**), similar to the distribution of direct costs associated with all diagnoses in which hospital expenditures were responsible for 46% of the direct costs. This pattern, however, did not hold for direct costs related to respiratory infections. Physician costs were the greatest portion of direct costs in this area, responsible for 43% of the direct costs.

Although communicable diseases represented only 9% of all costs, they were responsible for 6% of all direct costs and 34% of all indirect costs (**Table 2**). Most of the indirect costs associated with communicable diseases were associated with the morbidity costs, that is, the value loss in production due to morbidity. In fact, 28% of the expenditures due to morbidity were attributable to respiratory infections.

Respiratory infections were responsible for over $2.8 billion in indirect costs, with the common cold and influenza costing society $1.4 billion and $1 billion, respectively, in lost production. While the costs related to mortality were relatively low, pneumonia, HIV/AIDS, and hepatitis B accounted for over 70% of mortality costs.

Table 3 shows results by diagnostic subcategories, which shed some light on the contribution of specific communicable diseases to the overall economic burden of illness. Unfortunately, due to data limitations, it was not always possible to allocate the costs to subcategories. Specifically, the morbidity costs associated with "Certain Infectious and Parasitic Diseases" could not be further broken down by subcategory. Pneumonia represented the greatest proportion of hospital costs related to communicable diseases (34.7%); hepatitis B and bronchitis accounted for 10% and 11% of the drug costs related to communicable

Table 1: Costs by diagnostic category and cost-type (allocated expenditures only) 2005–2008 (current dollars)[1]

Diagnostic Category	Certain infectious and parasitic conditions			Respiratory infections			All communicable diseases			All other diagnostic categories			All allocated expenditures		
	$ millions	% direct costs	% all costs	$ millions	% direct costs	% all costs	$ millions	% direct costs	% all costs	$ (millions)	% direct costs	% all costs	$ millions	% direct costs	% all costs
Hospital	871.1	41.9	29.9	958.9	37.0	17.7	1,830.0	39.2	22.0	37,096.1	46.8	43.0	38,926.1	46.4	41.2
MD	509.3	24.5	17.5	1,125.2	43.4	20.8	1,634.5	35.0	19.6	22,145.8	28.0	25.7	23,780.3	28.3	25.1
Drug	696.7	33.5	23.9	509.3	19.6	9.4	1,206.0	25.8	14.5	19,981.6	25.2	23.2	21,187.6	25.3	22.4
Total direct	2,077.0		71.2	2,593.3		47.9	4,670.3		56.1	79,223.7		91.9	83,894.0		88.7
Morbidity	826.9	-	28.3	2,812.4	-	52.0	3,639.3	-	43.7	6,569.0	-	7.6	10,208.3	-	10.8
Mortality	13.0	-	0.4	5.1	-	0.1	18.1	-	0.2	435.9	-	0.5	454.0	-	0.5
Total indirect	839.9	-	28.8	2,817.6	-	52.1	3,657.5	-	43.9	7,004.8	-	8.1	10,662.3	-	11.3
Total	2,916.9			5,410.8			8,327.7			86,228.7			94,556.4		

Abbreviations: $ = Canadian dollars; % = percentage; MD = physician
[1]Source: *The Economic Burden of Illness in Canada, 2005-2008 (7)*

Table 2: Costs by cost-type and diagnostic category (allocated expenditures only), 2005–2008 (current dollars)[1]

Diagnostic Category	Hospital		Drugs		Physician		Total Direct		Morbidity		Mortality		Total Indirect		Total Costs	
	$ millions	%	$ millions	%	$ millions	%	$ millions	%	$ millions	%	$ millions	%	$ millions	%	$ millions	%
Certain infectious and parasitic conditions	871.1	2.2	509.3	2.1	696.7	3.3	2,077.0	2.5	826.9	8.1	13.0	2.9	839.9	7.9	2,916.9	3.1
Respiratory infections	958.9	2.5	1,125.2	4.7	509.3	2.4	2,593.3	3.1	2,812.4	27.6	5.1	1.1	2,817.6	26.4	5,410.8	5.7
All communicable	1,830.0	4.7	1,634.5	6.9	1,206.0	5.7	4,670.3	5.6	3,639.3	35.7	18.1	4.0	3,657.5	34.3	8,327.7	8.8
Other diagnostic categories	37,096.1	95.3	22,145.8	93.1	19,981.6	94.3	79,223.7	94.4	6,569.0	64.3	435.9	96.0	7,004.8	65.7	86,228.7	91.2
All allocated expenditures	38,926.1		23,780.3		21,187.6		83,894.0		10,208.3		454.0		10,662.3		94,556.4	

Abbreviations: $ = Canadian Dollars; % = percentage
[1]Source: The Economic Burden of illness in Canada, 2005–2009 (7)

diseases; the common cold was responsible for 16% of the physician costs associated with communicable diseases.

To examine hospital cost distribution by income quintile, we looked at all health conditions and communicable diseases only. In both cases, hospital care costs decreased with higher income. For all health conditions (**Figure 1**), 24% of costs were attributable to individuals in the lowest income quintile, while only 17% of costs were attributable to those in the highest income quintile.

The gradient was more pronounced for communicable disease costs and income. Individuals in the highest income quintile accounted for 16% of hospital costs whereas individuals in the lowest income quintile accounted for 27% of costs (**Figure 2**). For all health conditions, costs for individuals in the lowest income quintile were 43% higher than those in the highest income quintile. For communicable diseases, costs for individuals in the lowest income quintile were 73% higher than those for in the highest income quintile.

The burden associated with these socioeconomic inequalities can be calculated as the difference between costs associated with the highest quintile of individuals and the costs associated with each successive quintile. Using this method, the economic burden associated with socioeconomic inequalities was $307.5 million for hospital costs associated with communicable diseases. The burden for hospital costs related to all health conditions was $4.6 billion.

Figure 1: Hospital expenditures for all health conditions by income quintile

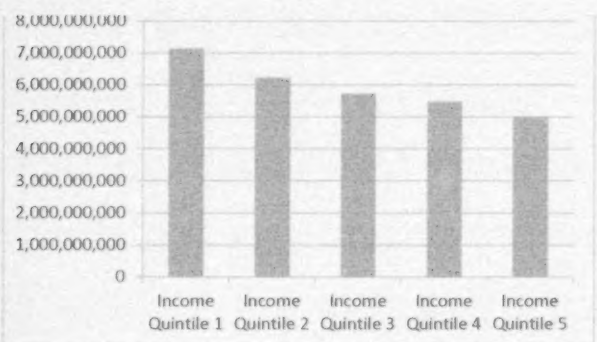

Figure 2: Hospital expenditures on communicable diseases by income quintile

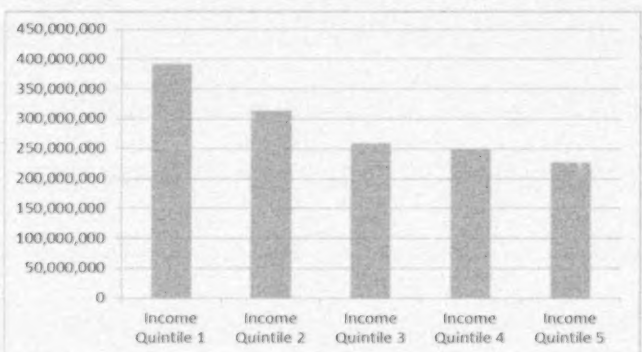

Table 3: Direct and indirect costs associated with communicable diseases, Canada, 2008 (current dollars)[1]

Diagnostic Category	Direct costs								Indirect costs						Total Costs	
	Hospital		Drugs		Physician		Total Direct		Morbidity		Mortality		Total Indirect			
	$ (millions)	%	$ (millions)	%	$ (millions)	%	$ (millions)	%	$ (millions)	%	$ (millions)	%	$ (millions)	%	$ (millions)	%
Certain Infectious and Parasitic Diseases																
Tuberculosis	24.6	1.30	1.8	0.10	9.1	0.60	35.5	0.8	-	-	0.2	1.1	0.2	-	35.7	0.4
Sexually Transmitted Diseases	25.5	1.40	10.3	0.90	12.9	0.80	48.7	1.0	-	-	-	-	-	-	48.7	0.6
HIV/AIDS	35.7	2.00	96.8	8.00	8	0.50	140.5	3.0	-	-	4.7	26.1	4.7	0.1	145.2	1.7
Diarrhoeal Diseases	159.9	8.70	43.9	3.60	82.9	5.10	286.7	6.1	-	-	0.4	2.2	0.4	-	287.1	3.4
Selected Vaccine preventable diseases	5.7	0.30	1.6	0.10	11.6	0.70	18.9	0.4	-	-	-	-	0	-	18.9	0.2
Meningitis	22.2	1.20	0.5	-	5.3	0.30	28	0.6	-	-	0.4	2.2	0.4	-	28.4	0.3
Hepatitis A	0.6	-	-	-	0.3	-	0.9	0.0	-	-	-	0.0	-	-	0.9	0.0
Hepatitis B	2.7	0.10	125.2	10.40	1.4	0.10	129.3	2.8	-	-	0.4	2.2	0.4	-	129.7	1.6
Hepatitis C	5.3	0.30	-	0.00	-	0.00	5.3	0.1	-	-	3	16.7	3	0.1	8.3	0.1
Malaria	1.2	0.10	1.4	0.10	0.5	-	3.1	0.1	-	-	-	-	-	-	3.1	-
Tropical-Cluster Diseases	0.2	0.00	-	-	0.2	-	0.4	-	-	-	-	-	-	-	0.4	-
Leprosy	0.3	-	-	-	0.9	-	1.2	-	-	-	-	-	-	-	1.2	-
Dengue	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-
Encephalitis	14.4	0.80	-	-	1.5	0.10	15.9	0.3	-	-	0.1	0.6	0.1	-	16	0.2
Trachoma	0	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	0.1	-
Intestinal Nematode Infections	0.4	-	0.5	0.00	0.8	-	1.7	-	-	-	-	-	-	-	1.7	-
Brucellosis	0.1	-	-	0.00	0.1	-	0.1	-	-	-	-	-	-	-	0.2	-
Rabies	0	-	-	0.00	0.2	-	0.2	-	-	-	-	-	-	-	0.2	-
Infectious Mononucleosis	5.6	0.30	0.4	0.00	6	0.40	12	0.3	-	-	-	-	-	-	12	0.1
West Nile Virus	2.5	0.10	-	0.00	-	-	2.5	0.1	-	-	-	-	-	-	2.5	-
Listeriosis	2.7	0.1	-	0.00	-	-	2.7	0.1	-	-	-	-	-	-	2.7	-
Other Infectious	561.5	30.7	414.3	34.40	367.5	22.50	1,343.3	28.8	-	-	3.7	20.6	3.7	0.1	1,347	16.2
Other / not-classified	-	-	-	0.00	-	0.00	-	-	826.9	22.4	-	0.0	826.9	22.6	826.9	9.9
Total Infectious and Parasitic Diseases	871.1	47.6	696.7	57.8	509.3	31.2	2077.2	44.5	826.9	22.4	12.9	71.7	839.8	23.0	2917	35.0
Respiratory Infections																
Pneumonia	634.1	34.7	47.1	3.9	111.6	6.8	792.8	17.0	-	0.0	4.9	27.2	4.9	0.1	797.7	9.6
Influenza	14.9	0.8	9.1	0.8	36.2	2.2	60.2	1.3	969.5	26.3	0.1	0.6	969.6	26.5	1,029.8	12.4
Bronchitis and Bronchiolitis	91.5	5.0	134.6	11.2	146.7	9.0	372.8	8.0	-	0.0	-	0.0	-	-	372.8	4.5
Common Cold	1.6	0.1	18.7	1.6	257.4	15.7	277.7	5.9	1,466.8	39.7	-	0.0	1466.8	40.1	1744.5	20.9
Otitis Media	51.1	2.8	74.3	6.2	203.8	12.5	329.2	7.0	-	0.0	-	0.0	-	0.0	329.2	4.0
Other Respiratory Infections	165.6	9.0	225.4	18.7	369.5	22.6	760.5	16.3	0.1	0.0	0.1	0.6	0.1	0.0	760.6	9.1
Other / not-classified	-	-	-	-	-	-	-	-	376.1	10.2	-	0.0	376.1	10.3	376.1	4.5
Total Respiratory Infections	958.8	52.4	509.3	42.2	1125.2	68.8	2,593.2	55.5	2812.4	76.1	5.1	28.3	2,817.6	77.0	5,410.7	65.0
Total (all communicable diseases)	**1,830.0**		**1,205.9**		**1,634.5**		**4,670.4**		**3,693.3**		**18**		**3,657.4**		**8327.7**	

Abbreviations: $ = Canadian dollars; % = percentage

[1]Source: *The Economic Burden of Illness in Canada, 2008 (7)*

Discussion

In 2008, the economic burden of illness in Canada for communicable diseases was $8.3 billion or 9% of the total economic burden of illness in Canada. Communicable diseases were responsible for 6% of all direct costs and 34% of all indirect costs, signifying the importance of disability associated with such diseases as HIV and hepatitis. In addition, the finding showed a clear cost to income gradient for hospital costs representing inequalities associated with the burden of such diseases; the gradient was much greater for communicable diseases than non-communicable diseases. For communicable diseases, costs for individuals in the lowest income quintile were 73% higher than those for in the highest income quintile. The majority of costs associated with communicable diseases were attributed to respiratory infection, specifically influenza and the common cold. These were responsible for 56% of the direct costs but 77% of the indirect costs. The results showing a socioeconomic gradient related to hospital expenditures are consistent with previous research reporting on the relationship between socioeconomic status and the need for and utilization of health care resources (8,9). Given the aggregate data used, it is not possible to assume a causal relationship between income and health status, but other evidence suggests that the directional relationship is generally from income to health and not vice versa (11-13).

Limitations

One of the main limitations of this study was that it did not include all of the potential economic costs associated with communicable diseases. EBIC 2008 included only the direct and indirect costs associated with diseases and did not include the value of pain and suffering or the value of life itself.

A second limitation is that the direct and indirect costs included in this analysis were not complete as many of the costs associated with illness, both direct and indirect, could not be properly allocated to a specific disease. This included a portion of the hospital, drug and physician costs; some whole categories have been excluded, such as spending on public health. With respect to the inequality analysis, some important components were excluded, such as out-of-pocket expenditures and expenditures for primary care, drugs and non-insured services. Such expenditures may serve as substitutes for hospital services and their inclusion would have provided a better picture of the inequalities.

In addition, lost production due to "presenteeism" was excluded from the analysis. "Presenteeism" refers to the concept when people go to work but work at a level of productivity of less than 100% due to illness. This may be a significant concern in relation to infectious diseases where people may be less likely to take time off work but show up at a reduced level of productivity. Furthermore, infected individuals showing up for work will likely increase the spread of infection, ultimately impacting many people in their organization.

A third limitation of this study relates to issues of diagnoses, comorbidities and the exclusion of sequelae associated with communicable diseases. The direct costs were all allocated to primary diagnoses and thus could not take into account all the impacts that communicable diseases had on expenditures. For example, many hospitalizations or deaths due to influenza are not diagnosed as such; many infectious diseases have multiple chronic sequelae such as cancer, liver diseases and infertility; large proportions of asymptomatic infections may be inaccurately attributed to non-infectious chronic diseases in mortality or even in morbidity data.

The impact of all these limitations is an underestimation of the true total costs associated with communicable diseases. As such, the findings of this study can be considered to be conservative.

Conclusion

In conclusion, the costs associated with communicable diseases are significant with a greater burden of hospital care on those with the lowest income compared to those with the highest income. More research is required to better understand the direct and the indirect costs associated with communicable disease and to see if these findings have changed in recent years. Work is underway to better identify hospital costs associated with comorbidities especially with respect to the complications of communicable diseases and adverse effects of treatment, such as those arising from antimicrobial resistance and the associated cost. Furthermore, more research on the true costs of the value of lost production, including better estimates of the disability costs and presenteeism, is needed. Better estimates of the economic burden associated with communicable disease can ultimately be used to improve the quality of economic evaluations, ensuring the most efficient allocation of scarce health care resources in combatting communicable diseases.

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Conflict of interest

None.

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Appendix: International Classification of Diseases chapters (ICD)[1] with communicable diseases

Chapter	Code	Part
ICD Chapter I: Certain infectious and parasitic diseases	A00–B99	Entire chapter
ICD Chapter VI: Diseases of the nervous system	G00	Bacterial meningitis, not elsewhere classified
	G03	Meningitis due to other organisms and unspecified causes
	G04	Encephalitis, myelitis and encephalomyelitis
	G05	Encephalitis, myelitis and encephalomyelitis in diseases classified elsewhere
ICD Chapter X: Diseases of the respiratory system	J00–J06	Acute upper respiratory infections
	J09–J18	Influenza and pneumonia
	J20–J22	Other acute lower respiratory infections
ICD Chapter XIV: Diseases of the genitourinary system	N70–N73	Salpingitis and oophoritis Inflammatory disease of uterus, except cervix Inflammatory disease of cervix uteri Other female pelvic inflammatory diseases

[1] Source: *World Health Organization (2004). International statistical classification of Diseases and health related problems: Tenth Revision. Geneva*

What can public health do to address inequities in infectious disease?

Moloughney BW[1,2*]

Abstract

Background: The recognition of the importance of social conditions informed early public health responses to infectious disease epidemics. By influencing exposure, vulnerability, and access to health services, social determinants of health (SDOH) continue to cause inequalities in infectious disease distribution. Such preventable and unjust inequalities are considered to be *inequities*.

Analysis: A number of challenges and barriers exist to more widespread public health action that addresses SDOH and inequities, including a lack of clarity on what public health should or could do. The National Collaborating Centre for Determinants of Health (NCCDH) has identified four primary roles for public health action on SDOH and inequities. This paper describes these roles and includes examples of their application to infectious diseases. The critical contribution that organizations make in providing the leadership and support for programs and staff to pursue action on SDOH and inequities is also highlighted.

Conclusion: While the challenge is large and complex, approaches such as the NCCDH roles for public health action provide a menu of options to facilitate the analysis and action to address SDOH and inequities in infectious diseases.

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Introduction

Modern public health came about in response to the epidemics that occurred after the onset of the Industrial Revolution. With mass migration to cities, poor living conditions due to overcrowded and poorly ventilated housing, contaminated drinking water and indiscriminate disposal of sewage enabled the spread of infectious diseases. The marked differences in mortality between population groups prompted the advocacy efforts of the Sanitary Movement to improve the living conditions of the poor (1).

Today, these conditions are referred to as the social determinants of health (SDOH) and defined as the "interrelated social, political and economic factors that create the conditions in which people live, learn, work and play" (2). Health inequities, in turn, are health inequalities in which the differences are associated with modifiable and unfair social disadvantages (2). From the *Ottawa Charter on Health Promotion* (3) to the *Report on the Health of Canadians* (4) to the contributions to the World Health Organization Commission on Social Determinants of Health (5), Canada has emphasized the importance of health determinants and inequities on an international scale. Nevertheless, health-care practitioners and public health organizations can struggle with identifying what exactly they should and can do to address inequities (6). While acknowledging the complexities and barriers to addressing health equity issues, this paper describes a set of roles for public health to use to address inequities in the context of infectious diseases.

Analysis

The distinction between health inequalities and inequities is important. Health inequalities refer to measurable differences in health between individuals, groups or communities (2). For example, the rate of disease X in population Y differs from the rate in population Z.

As defined earlier, health inequities are inequalities in which the differences in health are associated with modifiable social disadvantages that many consider unfair (2). Underlying the concept of health equity is a commitment to social justice and basic human rights such as access to clean water, food, education and health care (7).

One approach to thinking about how SDOH influence disease is to consider how they influence exposure, vulnerability and access to health services (8). SDOH affect all three of these aspects in the case of tuberculosis (TB), for example: they increase the risk of exposure when people live in crowded, inadequately ventilated housing; they increase vulnerability to infection when nutritional intake is inadequate; and they decrease access to health services (9). Even in a country like Canada with universal health care, access issues include the availability of health-care providers and diagnostic equipment in remote areas; payment barriers for some classes of refugee applicants; the costs of transportation and missing work to attend appointments; and the level of trust toward health-care practitioners (10).

While TB is no longer common in Canada, the incidence rate of active TB in the Canadian-born Aboriginal population is 34 times higher than for the Canadian-born non-Aboriginal population (11). Since TB is preventable and curable, the inequality of TB rates in Aboriginal populations reflects a health inequity. Inequities for TB also exist for foreign-born individuals. For example, the extent of SDOH barriers to access to care for this population has prompted Toronto Public Health to add a social worker to its TB program to address housing, income and immigration issues (10).

Analyzing the influence of SDOH on exposure, vulnerability, and access to health services is applicable to other infectious diseases. But understanding does not guarantee action. An environmental scan conducted by the National Collaborating Centre for Determinants of Health (NCCDH) in 2010 reported a number of barriers to more widespread public health action on SDOH and inequities (6):

- lack of clarity about what public health should or could do;
- limited evidence base on what works to mitigate the effects of SDOH on health;
- preoccupation with behaviour and lifestyle approaches;
- bureaucratic organizational characteristics;
- limitations in organizational capacity; and
- the need for leadership, more effective communication and supportive political environments.

A key conclusion of the NCCDH scan was that while analyses of and action on health determinants and inequities are not new to public health, the approaches to address them were never institutionalized and/or were lost due to other pressures (6). To address this, the NCCDH recommended four primary roles for public health, which the Centre adopted to guide its knowledge translation work to advance SDOH and health equity through public health practice and policy (12). These roles are described below.

Assess and report on the existence and impact of health inequities and effective strategies to reduce these inequities

The role of assessing and reporting on health inequities and effective strategies to reduce their existence and impact comes most naturally to public health organizations and is fundamental to informing action for the other three roles. Recent examples applied to infectious diseases include, but are not limited to, the 2013 report from the Chief Public Health Officer of Canada, which highlights inequities in TB (11), and the City of Toronto report on health inequities, which highlights the inequities in chlamydia rates among Toronto youth (13).

Both reports provide high level guidance for steps to address the observed inequities. In the NCCDH environmental scan, many key informants indicated that public health needs to move beyond merely describing inequities to taking action and addressing them (6), which is the focus of the following three roles.

Modify and orient interventions and services to help reduce inequities, with an understanding of the unique needs of populations that experience marginalization

Understanding the unique needs of populations is about ensuring that the planning of public health interventions and services consider and address inequities. An increasingly common approach is for organizations to incorporate equity assessments into their operational planning cycles (14). An excellent example of this is Saskatoon Population and Public Health's audit of its immunization program, which detected marked differences between neighbourhoods in immunization coverage rates, with the lowest rates in lower-income neighbourhoods (15). Subsequent changes in practice, including redistributing program resources and using parent/guardian reminders, were associated with reductions in the differences in neighbourhood coverage rates (16).

Partner with other government and community organizations to identify ways to improve health outcomes for populations that experience marginalization

Due to the complex interdependencies of SDOH, many organizations, in addition to public health, are working to address the needs of particular populations. With different mandates and perspectives, and the pervasiveness of SDOH, service barriers and gaps can nevertheless persist. Better coordination and joint planning by system actors are needed to prevent and address such gaps. For example, in Manitoba, a Tri-Partite Table was established during and after the H1N1 pandemic between the provincial government, the federal government, the Assembly of Manitoba Chiefs, the Manitoba Métis Federation, and representatives of regional health authorities to foster better communication between and coordination among the parties, with consensus reached on many issues (17). Such partnering should lead to more lead to more effective and efficient service delivery.

Lead, support and participate with other organizations in policy analysis and development, and in advocacy for improvements in health determinants and inequities

Participating in policy development and advocacy is a key role for public health since structural change of SDOH has the greatest potential impact on the population's health (18). Policies can target one or more of the SDOH's influences on exposure, vulnerability and/or access. For example, the British Columbia Provincial Health Officer's report *HIV, Stigma and Society: Tackling a Complex Epidemic and Renewing HIV Prevention of Gay and Bisexual Men in British Columbia* (19) identified several subpopulations that are more vulnerable due to social, political and environmental factors. Stigma, verbal harassment and violence result in a variety of adverse health risks including increased sexual risk-taking behaviour and greater barriers to accessing appropriate health care, as well as a greater likelihood of poor mental health outcomes. The Provincial Health Officer recommends enhancing protective factors such as comprehensive and inclusive sexual health education that challenges stigma and fosters decision-making skills; improving and expanding health care for HIV-positive individuals; advancing support for mental health and substance use services; and revisiting prosecutorial guidelines to do with HIV (19).

Addressing the barriers to action

The roles proposed by NCCDH consider what public health can do to address SDOH and inequities in health that also include infectious diseases. Despite public health's historical roots and all the knowledge about SDOH and inequities, an additional barrier to action is the perception that addressing SDOH and inequities would be "extra work" for public health organizations (6). To address this issue, jurisdictions are increasingly incorporating explicit expectations in their core programs/standards. For example, the following provincial public health programs have incorporated the mitigation of inequities into the mandate of their public health activities:

Québec Public Health Program (20)

- Key strategies include community development and participation in intersectoral action to promote health and support for vulnerable groups

A Framework for Core Functions in Public Health (BC) (21)

- Includes a "lens' through which to assess and address health inequalities
- Identifies eight ways public health can help reduce health inequalities

Ontario Public Health Standards (22)

- Identifies addressing determinants of health and reducing inequities as fundamental to the work of public health
- A key requirement is to identify and work with local populations that are a priority

Nova Scotia Public Health Standards (23)

- Incorporates the four NCCDH-defined roles (assess and report on inequities and effective strategies; modify public health interventions; partner with other health service providers; conduct policy analyses, development and advocacy) in a foundational standard.

In developing the Nova Scotia Public Health Standards, a practical challenge was identified for infectious disease prevention and control (IDPC) staff to pursue action on SDOH and inequities. While IDPC professionals possess key knowledge and insights to inform understanding and action on underlying SDOH that are driving adverse health outcomes, operational demands of day-to-day responsibilities limit the available time to pursue such actions. One suggested approach was for organizations to support these IDPC staff to provide input into SDOH initiatives, while dedicated staff from elsewhere in the organization, such as health promoters, could pursue longer-term actions to influence SDOH through healthy public policies and other strategies.

Conclusion

Action on SDOH and inequities is intrinsic to public health practice. Such action is reflected in the historical roots of public health, described in decades of landmark reports and explicitly included in core programs. While a number of barriers exist, primary public health roles for action have been identified and applied to infectious diseases and other conditions.

While action on SDOH and inequities involves individual practitioners, public health action predominantly reflects organizational level processes and outputs (6). For example, producing a report that highlights inequities or partnering with other sectors to pursue policy change requires a conscious organizational decision. Fulfilment of any of the four NCCDH-defined roles requires leadership to establish priorities, allocate resources, model behaviours and attitudes, educate the public and decision makers and build the organization's capacity to undertake this work (6).

At the systems level, leadership and communication are also required to make public health roles and responsibilities explicit and provide the political support for public health involvement and action. While the challenge is large and complex, approaches such as the NCCDH roles for public health action provide a menu of options to facilitate the analysis and action to address SDOH and inequities in infectious diseases.

Conflict of interest

None.

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Infectious disease, social determinants and the need for intersectoral action

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Abstract

Effectively addressing infectious diseases requires a broad multifaceted approach. Public health efforts in the 19th century emphaasized cleanliness and good living conditions. The germ theory of disease that subsequently prevailed led to some important breakthroughs in vaccines and antimicrobials—but also bred complacency. Now, in light of emerging and re-emerging infections and antimicrobial resistance, we know that a unidisciplinary approach to infectious disease control is no longer sufficient and that it is through working with others that we can identify practical ways to address all the factors at play in the emergence and persistence of infectious diseases. When working across sectors, inter-professionally or with intergovernmental or coalition activities, there are four important principles to apply: respect, practicality, the rule of three and having something to offer.

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Introduction

Tackling the challenge of infectious disease has always required a broad multifaceted approach. As our understanding has evolved, this approach has expanded to include the concept of social determinants of health (SDOH) to better address the complex interplay between the conditions in which we live and our ability to foster health and recover from illness (1). This paper describes the history of our understanding of infectious diseases, from germ theory to the determinants of health and beyond, identifies the need for an intersectoral approach and relates principles that foster coalition building and effective intersectoral action.

Germ theory

The germ theory of disease led to some important breakthroughs that helped in the eradication of some diseases and the near elimination of others through the use of vaccines and antimicrobials. Nevertheless, the theory was very controversial and much debated in the 19th century. There were, for example, those who feared that if we concluded germs were the actual cause of disease, people would no longer be motivated to clean up the dirty conditions in which infections often arose (2).

The mid-20th century was marked by the hubris that infection was no longer a serious threat to humanity (3). As germ theory became widely embraced, the tendency to become a little more complacent with the surrounding conditions became an issue. For example, during surgery, people assumed that antibiotics could address any risk of postoperative infection and became a little more lax with aseptic technique. Overall, less attention was paid to infection control and public health efforts.

Complacency regarding infectious diseases is now largely absent. This change began in the 1980s and 1990s with the onset of the HIV epidemic and continued through the 2000s, with the SARS and pandemic H1N1. The emergence of antimicrobial resistance (e.g. multidrug-resistant tuberculosis), new infectious diseases (e.g. the Ebola virus) and the re-emergence of old infectious diseases thought to be vanquished (e.g. pertussis) have also challenged complacency.

The more we know about infection, the more we realize we have to learn. Prions and related protein misfolding disorders point to a type of infectious disease not caused by a microorganism—and this will likely not be the last form of infectious organism we discover (4). And with each year, new insights increase our understanding of how microorganisms cause or promote a growing range of diseases and immune disorders.

The interplay of microbes and social determinants

We have come to recognize, or perhaps rediscover, the significant influence of social determinants on rates of infectious and noninfectious disease and mortality. Where we live and how we behave—our social, environmental and economic context—all bear on our well-being and survival.

So, in a way, we have come full circle. We realize that the germ theory of disease was a little too simple, and now have a more nuanced understanding of the role microorganisms play in a range of diseases, their function in promoting normal physiological processes, such as digestion, and their complex interplay with immunity (5). But we also realize that there was a lot of substance in the early public health movement, with its focus on better sanitation and generally improving economic and

social conditions. While, overall, social and economic conditions for health have significantly improved over the last century, especially in developed countries, neglecting to address social determinants has given rise to inequity (6,7). To successfully prevent and manage disease and injury, we must take into account all we know about microorganisms, vaccines, treatments and SDOH. With that in mind, the concept of One Health is gaining acceptance as another way of thinking about the problems we face. The interface of animal, human, environment and economic factors is where many solutions to our more complex challenges lie.

A fascinating example of the interplay of SDOH and microbes is the fact that the incidence of TB started to decline in much of Western society prior to the advent of successful medical therapies (8). Better housing, less overcrowding, improved nutrition and living conditions, and pasteurization, among other factors, contributed to a precipitous decline in rates of TB in the 19th and early 20th century in Europe and North America (9).

Ironically, although a number of effective treatments for TB were developed in the latter half of the 20thcentury, the disease has not been eliminated. This is due to a complex combination of SDOH, immunological factors (such as the increase in TB in those with HIV), and the emergence of multidrugresistant strains of the bacteria (10). TB remains endemic in many countries including in the Americas, among indigenous populations. One key to a longer-term solution to TB in Canada's North is access to adequate housing in addition to prevention and treatment (11-13).

TB is not the only example of an important interplay between microbes and SDOH. The burden of methicillin-resistant *Staphylococcus aureus* (MRSA) and respiratory syncytial virus (RSV) is associated with inadequate housing and poverty (14,15). Even the burden of HIV/AIDS—who gets it and how well they respond to treatment—is related to SDOH. For example, people with HIV who have stable housing are more likely to have better treatment adherence (16).

Effectively addressing infectious disease means no longer debating whether to focus on social or on medical, biological or environmental factors (17,18); all these factors are important. This also suggests that no one person or group can address all infectious diseases. In fact, to effectively address infectious diseases today requires multiple skill sets—knowledge of infectious disease, public health and SDOH and the ability to work with local communities, governments and non-governmental organizations.

Why we need coalitions and intersectoral action

Unidisciplinary disease control strategies will never be truly sufficient to combat many infectious diseases: the underlying determinants of health also need to be addressed. If we keep in mind the importance of SDOH and other non-microbial factors when organizing health services, we are more likely to come up with effective strategies.

An example of the effective multidisciplinary application of infectious disease control is the use of a vaccine to stop the periodic outbreaks of hepatitis A in small remote communities in Saskatchewan. While advocating for improvements in housing and social conditions, the health care system offered immunization and, as a result, brought down the rates of the disease in those communities to below that of the province as a whole. (*Unpublished Saskatchewan Communicable Disease data 1994–99, Dr. Shauna Hudson*).

One of the challenges of addressing SDOH is that they are not simply deterministic. In other words, just because a person is financially better or worse off is not in itself a reason for good or ill health. Poverty is not just an economic issue; it is a constellation of lack of assets, connections, self-determination, environment, etc. Some communities thrive much better than others with similar levels of income, environment, genetics and basic culture. And these can be mitigated further with appropriate supports in education, health and social services.

With such diversity in the human condition and approaches to dealing with issues, one of our key challenges is helping communities journey from where they are to what they could be.

Sometimes the issues of poverty, social, environmental and economic factors and our ability to influence them seem overwhelming. While no one can do it all, and some challenges seem insurmountable, breaking the problems down in practical ways can be helpful in assuring positive action.

Principles for working with multiple sectors and coalitions

No one ideal technique or model is suited to all people or situations. The key is improving our understanding of the various factors underlying risks and benefits to health through working with others so that we can identify practical ways to address all the factors that may be at play.

The skills required to address infectious diseases in the context of social determinants may take us beyond our usual roles. Diplomacy, coalition building, community development are just some of the key capacities that allow us to address the risks and underlying factors. Four important principles apply.

Respect

We cannot influence who or what we do not respect. While it is not necessary to look on those we work with to achieve shared goals as friends—or even to agree with them—we need to respect them as people and appreciatethe challenges they face and their aspirations. Only then can the conversation about potential change take place. When we feel frustrated over differences, a harangue may feel therapeutic but these rarely lead to a significant change in perspective; the most common reaction is wanting as little as possible to do with the haranguer. So working in a spirit of respect is critical.

Make it practical

It is not enough to identify the problems. Policymakers and others also need practical, doable solutions that are demonstrable and/or feasible. Applying what we already know or can gather from experience elsewhere and understanding effective implementation can mean going a long way without the need for new strategies and technology.

The rule of three

Too often the things people disagree about become the focus of meetings and hinder progress. To address this, stop, take

stock and divide the issues up into three areas: those that can be agreed on, those that are not perfect but can be lived with, and those that are very unlikely to be agreed on. While not completely ignoring the last category, focussing most of the effort on the others prevents just the one category consuming more than a small part of the available time and energy.

Have something to offer

It is rare that one single organization has either the mandate or capacity to address large complex issues alone. The reason for coalitions is that different groups have different things to offer, so identifying what you or your organization can offer is very useful. A conversation that goes along the lines of "We could do this if you could do that" has been a useful technique for breaking the logjam of problems circling between organizations.

Conclusion

Enhancing our biomedical approach to address infectious diseases with effective approaches based on the SDOH and One Health will be a key to long-term success. Whether in medicine or policy, the basics matter. Ensuring the least intrusive, most effective approaches with the fewest side effects serves us all well.

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The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) Trial

Source: Sanitation Hygiene Infant Nutrition Efficacy (SHINE) Trial Team. The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) Trial: Rationale, Design, and Methods. Clin Infect Dis. 2015 Dec 15;61 Suppl 7:S685-702. doi: 10.1093/cid/civ844. http://www.ncbi.nlm.nih.gov/pubmed/26602296

Child stunting and anemia are intractable public health problems in developing countries and have profound short- and long-term consequences. The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) trial is motivated by the premise that environmental enteric dysfunction (EED) is a major underlying cause of both stunting and anemia, that chronic inflammation is the central characteristic of EED mediating these adverse effects, and that EED is primarily caused by high fecal ingestion due to living in conditions of poor water, sanitation, and hygiene (WASH). SHINE is a proof-of-concept, 2 × 2 factorial, cluster-randomized, community-based trial in 2 rural districts of Zimbabwe that will test the independent and combined effects of protecting babies from fecal ingestion (factor 1, operationalized through a WASH intervention) and optimizing nutritional adequacy of infant diet (factor 2, operationalized through an infant and young child feeding [IYCF] intervention) on length and hemoglobin at 18 months of age. Within SHINE we will measure 2 causal pathways. The program impact pathway comprises the series of processes and behaviors linking implementation of the interventions with the 2 child health primary outcomes; it will be modeled using measures of fidelity of intervention delivery and household uptake of promoted behaviors and practices. We will also measure a range of household and individual characteristics, social interactions, and maternal capabilities for childcare, which we hypothesize will explain heterogeneity along these pathways. The biomedical pathway comprises the infant biologic responses to the WASH and IYCF interventions that ultimately result in attained stature and hemoglobin concentration at 18 months of age; it will be elucidated by measuring biomarkers of intestinal structure and function (inflammation, regeneration, absorption, and permeability); microbial translocation; systemic inflammation; and hormonal determinants of growth and anemia among a subgroup of infants enrolled in an EED substudy. This article describes the rationale, design, and methods underlying the SHINE trial.

Emerging Infections Program Efforts to Address Health Equity

Source: Hadler JL, Vugia DJ, Bennett NM, Moore MR. Emerging Infections Program Efforts to Address Health Equity. Emerg Infect Dis. 2015 Sep;21(9):1589-94. doi: 10.3201/eid2109.150275. http://www.ncbi.nlm.nih.gov/pubmed/26291875

The Emerging Infections Program (EIP), a collaboration between (currently) 10 state health departments, their academic center partners, and the Centers for Disease Control and Prevention, was established in 1995. The EIP performs active, population-based surveillance for important infectious diseases, addresses new problems as they arise, emphasizes projects that lead to prevention, and develops and evaluates public health practices. The EIP has increasingly addressed the health equity challenges posed by Healthy People 2020. These challenges include objectives to increase the proportion of Healthy People-specified conditions for which national data are available by race/ethnicity and socioeconomic status as a step toward first recognizing and subsequently eliminating health inequities. EIP has made substantial progress in moving from an initial focus on monitoring social determinants exclusively through collecting and analyzing data by race/ethnicity to identifying and piloting ways to conduct population-based surveillance by using area-based socioeconomic status measures.

Useful links

Public Health Agency of Canada. Travel Health Notice: Zika virus in the Americas. http://www.phac-aspc.gc.ca/tmp-pmv/notices-avis/notices-avis-eng.php?id=143

Public Health Agency of Canada. **Canadian Best Practices Portal: Social Determinants of Health.** http://cbpp-pcpe.phac-aspc.gc.ca/public-health-topics/social-determinants-of-health/

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